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cobiax

HOW TO COBIAX

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HOW TO COBIAX

The Quick Guide
to Cobiax CLS

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Introduction

This Quick Guide is designed to give you a short introduction to the Cobiax technology. Additional information is available upon request or as a download from cobiax.com.
We strongly recommend the use of our free Cobiax CQL software tool (Cobiax Quick and Light). Our sales personnel will also be happy to answer your questions.

Technology and products

Cobiax technology uses recycled lightweight (hollow) void formers to replace the heavy concrete inside a slab where it is not required.

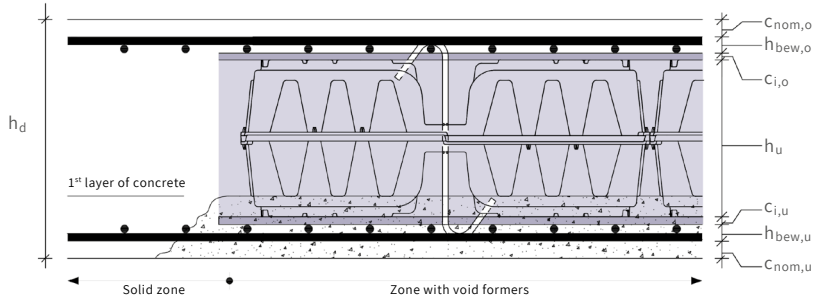
The resulting savings of up to 35% in concrete and weight has a positive effect on the construction of the slab itself (e.g. less deflection, larger span or thinner slab thickness) and hence on the whole building structure.

The internationally patented Cobiax CLS structural formers which are fully approved by the building authorities as well, feature a uniform base area of 23.62" x 23.62" and are made from 100% recycled plastic.

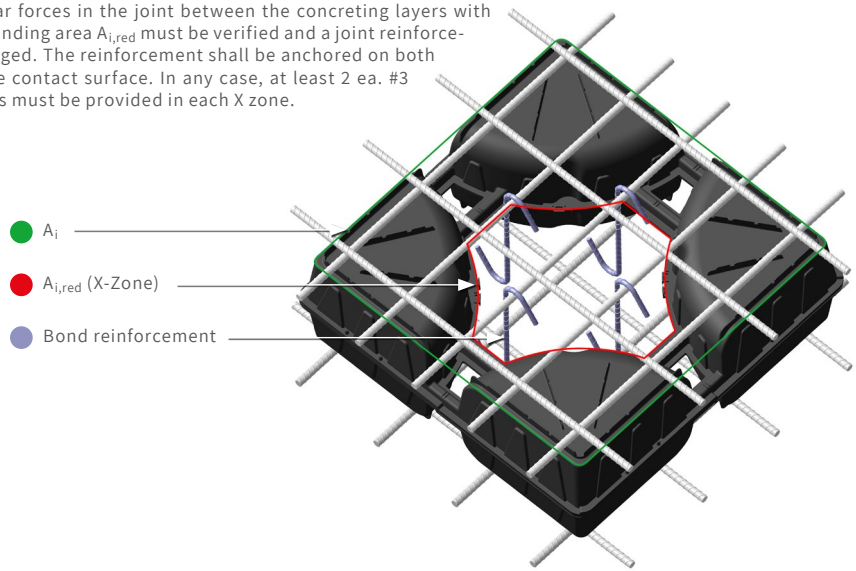
Cross section view

$h_{d,min} \le h_d \le h_{d,max}$

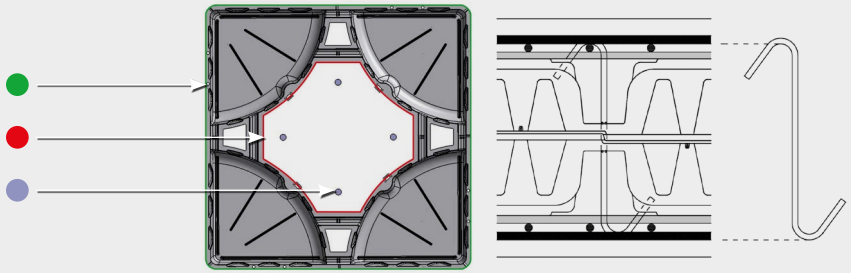
$h_u \le h_d - (c_{nom,o} + h_{bew,o} + c_{i,o} + c_{nom,u} + h_{bew,u} + c_{i,u})$
$d_{2,hk,min} \le c_{nom,o} + h_{bew,o} + c_{i,o} + h_{dis,o}$
$d_{2,hk,min} \le c_{nom,u} + h_{bew,u} + c_{i,u} + h_{dis,u}$



When casting the concrete in two layers, the transmission of the horizontal shear forces in the joint between the concreting layers with reduced bonding area $A_{i,red}$ must be verified and a joint reinforcement arranged. The reinforcement shall be anchored on both sides of the contact surface. In any case, at least 2 ea. #3 Omega bars must be provided in each X zone.



Example of bond reinforcement



Design and detailing

A Cobiax voided slab with CLS structural formers can be designed and planned by any structural engineer in compliance with the country-specific standards and the General Building Approval (abZ) of the German Institute for Construction Technology.

1. Slab cross-section and design parameters

After estimating the slab thickness h_d, a suitable Cobiax CLS structural former module is selected, taking into account concrete cover c_{nom}, the rebar layers h_{bew} and any intermediate layers c_i (e.g. for additional spacers or concrete core thermal activation). The support height h_u is decisive here. Additional requirements for the fire resistance have to be taken into account if necessary. The load reduction of structural formers, the associated stiffness factor for the bending stiffness f_{EI} and the shear resistance factor f_V (or the reduced shear resistance $V_{Rd,c,cobiax} = f_V \cdot V_{Rd,c}$) can be found in the table on the next page. Alternatively the free CQL software tool (Cobiax Quick and Light) can be used for quick preliminary calculation.

2. First run of structural calculation

The calculation of a Cobiax voided slab is to be done in a similar manner as that of a reinforced concrete slab, taking into account these 3 input parameters. With the first run of the structural calculation the load reduction and the reduced stiffness is applied for the whole slab.

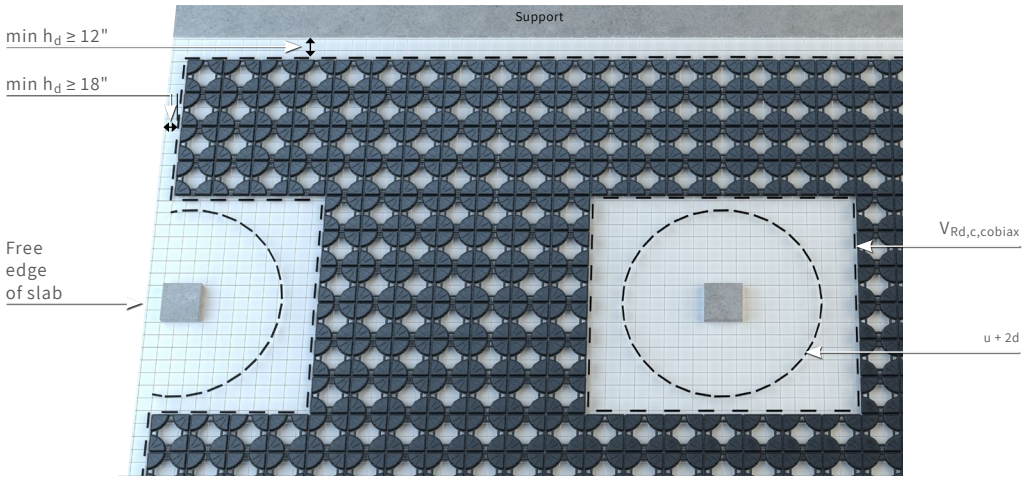
A consideration of the shear forces leads to the determination of the required solid zones. Areas with $V_{Ed} > V_{Rd,c,cobiax}$ must remain without voids.

In areas of punching shear it is necessary to check whether the solid zone extends beyond the critical circular cross section or the last row of reinforcement by at least the dimension $2d$. Otherwise the solid zone must be enlarged accordingly.

Along linear supports, a free solid zone with a width of at least the slab thickness h_d but not less than 12" must be provided by design, along free slab edges with a width of at least the slab thickness h_d but not less than 18".

3. Second run of structural calculation

The dead load and if necessary, the bending stiffness are adjusted (back to full dead load and stiffness) in the solid zones without structural formers and a second, final run of structural calculation has to be done.



Approx. 50% to 80% of the slab area is fitted with void formers (may vary according to different structural configuration)

4. Detailed design check

Casting the concrete in two layers (to prevent uplift of the void formers) requires a design detail check for the transfer of horizontal shear forces in the joint between both concrete layers considering the reduced bonding area $A_{i,red}$ due to the structural formers, see CQL software tool (Cobiax Quick and Light). In any case, at least 2 ea. #3 Omega bars must be provided in each X zone.

Execution on site

The contractor installs the Cobiax structural formers immediately next to each other according to the Cobiax layout drawing between the top and bottom reinforcement layers. In-situ solution as well as prefabricated solutions are possible. The void formers are usually secured against uplift by casting the concrete in two separate layers. After the first concrete layer (approx. 3" to 5" thick only in the area of the void formers) has hardened, the CLS modules are finally fixed and ready for the second layer of concrete. This can be done within a few hours, depending on the temperature, weather conditions and concrete properties.

Empty pipes (≤1") may be placed at the height of the connecting webs. Cobiax can also be combined with post-tensioning and/or in-slab heating and cooling elements.

Application Data

Cobiax CLS

				CLS-P-110	CLS-P-130	CLS-P-150	CLS-P-170	CLS-P-190	CLS-P-210	CLS-P-230	CLS-P-250	CLS-P-270	CLS-P-290	CLS-P-310	CLS-P-330	CLS-P-350	CLS-P-370	CLS-P-390	CLS-P-410	CLS-P-470	CLS-P-530	CLS-P-590
1	Volume displacement	h_{cx}	cf/ft²	0.15	0.19	0.22	0.26	0.3	0.33	0.35	0.38	0.42	0.45	0.47	0.51	0.54	0.54	0.57	0.63	0.72	0.78	0.85
2	Associated weight reduction (150 psf)	g_{cx}	psf	22	28	34	39	45	49	53	57	63	67	71	76	81	81	86	94	108	118	128
3	Support height	h_u	in	4.3	5.1	5.9	6.7	7.5	8.3	9.1	9.9	10.6	11.4	12.2	13	13.8	14.6	15.4	16.2	18.5	20.9	23.2
4	Min. slab thickness (Assuming #5 T&B/EW)	$h_{d,min}$	in	**9**	**9.5**	**10.5**	**11**	**12**	**13**	**13.5**	**14.5**	**15**	**16**	**17.5**	**18**	**19**	**20**	**21**	**22**	**24**	**28**	**30**
5	Max. slab thickness	$h_{d,max}$	in	15	16	17	17	18	19	20	20	21	22	23	24	24	25	26	27	29	31	31
6	Min. thickness of concrete cover to void (top/bottom)	$d_{2,Hk,min}$	in	2.4					2.8					3.1					3.5		3.9	
7	Distance void to upper edge of installation element	$h_{dis,o}$	in	0.6																		
8	Distance void to lower edge of installation element	$h_{dis,u}$	in	0.6																		
9	Limit slab thickness for $V_{Rd,c,cobiax}$ calculation	$h_{d,grenz}$	in	30																		
10	Shear factor (with $h_{d,min}$)	f_V		0.45	0.45	0.44	0.44	0.44	0.43	0.43	0.42	0.42	0.41	0.41	0.40	0.40						
11	Stiffness factor (with $h_{d,min}$ and centric position)	f_{EI}		0.96	0.94	0.93	0.91	0.89	0.90	0.88	0.87	0.86	0.85	0.86	0.85	0.84	0.83	0.82	0.83	0.81	0.80	0.79
12	Reduced bonding area	$A_{i,red}$		0.21 A_i																		
13	Concrete min. f'c		psi	4,000 – 8,000																		
14	Aggregate for max. grain size		in	¾																		
15	CO_2-Emission reduction		lbs/ft²	2.048	2.458	2.867	3.482	3.892	4.301	4.711	5.120	5.530	5.940	6.144	6.554	7.169	6.964	7.578	8.193	9.422	10.241	11.060
16	Associated area per installation element		ft²/pc	3.875																		
17	External dimension		in	23.62 x 23.62																		
18	Void volume		ft³/pc	0.6	0.7	0.9	1.0	1.2	1.3	1.4	1.5	1.6	1.7	1.8	2.0	2.1	2.1	2.2	2.4	2.8	3.0	3.3
19	Min. center distance of void formers	e	in	23.62																		